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Subject: Bark Beetle Activity in Forest Health Projects on the Payson RD (paysonrd)

To: District Ranger, Payson RD, Tonto NF

On September 8, 2004, I visited the Payson RD, Tonto NF, at the request of Jim Mercer, Forest Silviculturist, to evaluate the current and potential forest health projects for bark beetle activity. Jim and I conducted a brief survey of bark beetle activity within the Whisper Forest Health/Restoration Project north of Payson. I describe in this report what bark beetle activity was observed in these areas, summarize silvicultural treatments to reduce bark beetle stand susceptibility, and make recommendations to minimize bark beetle impacts.

Bark beetle activity on the Tonto National Forest

Both aerial detection surveys and ground surveys conducted by FHP have found high levels of bark beetle-killed ponderosa pine on the Tonto NF over the last three years. Inspection of fading trees and collected specimens determined that several species of pine engraver beetles (*Ips pini*, *I. lecontei*, *I. calligraphus*) and western pine beetle (*Dendroctonus brevicomis*) are the primary cause of pine mortality. These bark beetles are widespread throughout the West and can occasionally reach outbreak proportions (Kegley, et al., 1997; DeMars and Roettgering, 1982; Parker, 1991). In 2002, most of the trees were initially attacked by *Ips* species and then subsequently infested by western pine beetle. This allowed western pine beetle populations to increase. Starting in the summer of 2003 and continuing in 2004, we have seen attacks on many large diameter pines and pockets of second growth pine initiated by western pine beetle.

A detailed summary of the aerial detection survey results will be provided to the Forest at a later date; however, our analysis showed that ponderosa pine mortality occurred on more than 160,000 acres in late 2002 through mid-summer 2003. For the period of late 2003 through mid-summer 2004, an additional 6,365 acres were being impacted by bark beetles (*Ips* and western pine beetle) on the Forest. This trend of decreased activity is similar to what has been observed in the majority of Arizona during 2004. However, there are still areas that are experiencing considerable pine mortality and the population of bark beetles is still relatively high.

Forest Health and Fuels Reduction Projects

Beginning in fiscal year 2001, the Payson RD began implementing wildland urban interface (WUI) treatments around several subdivisions located north of Payson (i.e. Verde Glen, Rim Trails, Whispering Pine). The primary goals for these treatments were to improve forest health, reduce hazardous fuels and fire risk to surrounding communities, and to reduce the susceptibility to bark beetle attack. Treatments have been completed to several areas covered under previous NEPA analysis (Bullowl Timber Sale Environmental Analysis) and future planned treatment of four addition units have been analyzed in the Verde WUI Fuel Treatments EA. Treatment of



these four units in the Whisper Restoration Project area (357 total acres), when combined with the previously treated areas, are designed to provide more complete vegetation treatment within ½ to 1 mile of these subdivisions. The Payson District proposes treatment of these Whisper units, by means of precommercial thinning, to reduce the understory and midcanopy vegetation densities and corresponding competitive interaction.

Jim Mercer and I examined the areas proposed areas for bark beetle activity and general stand conditions. Areas inspected included along Forest Service roads 195 and 32. Most of these areas had stand basal areas greater than 120 ft.²/ac (**Figures 1**) and/or a heavy understory component of manzanita, juniper and oak (**Figure 2**). High levels of pine mortality had occurred throughout much of the area north of Payson in 2002 and 2003 and therefore stands contain much standing and down large diameter fuels. Based on our inspection of stands within the four units to be treated, these areas were experiencing moderate levels of current bark beetle activity (**Figure 3**). Thus, the current stand conditions have both a high fire risk and bark beetle hazard.

The District proposes to treat these units with a precommercial thinning that will thin ponderosa pine up to 8.9" dbh, juniper up to 10.0" dbh, and oak up to 6.0" dbh and remove all manzanita ≥ 2 feet in height (live or dead). All activity created slash will be hand piled for burning by the Forest Service. These treatments would result in ponderosa pine basal area to be reduced to lower than 60 ft.²/ac and total basal area of less than 120 ft.²/ac. The proposed treatments are a mid-level approach that will reduce stand density, beetle susceptibility, and fire risk without wasting merchantable material.



Figures 1 and 2. Current stand conditions within the proposed sites for forest health projects on the Payson RD, Tonto NF.

Silvicultural treatments for reducing bark beetle susceptibility

Management of bark beetle populations falls under two categories: direct action against the beetles themselves (suppression) or indirect action that addresses the general stand conditions (prevention). Direct action deals with the symptoms, too many beetles in one place at one time, and is aimed at directly reducing the number of beetles present. Indirect action focuses on the cause of the problem, which relates to optimal stand conditions for beetle buildup and outbreak. The only effective long-range strategy to minimize beetle-caused mortality is controlling stand conditions through silvicultural means over large areas and constant monitoring for areas of beetle buildup.

Silvicultural treatments are designed to increase tree vigor and reduce stand susceptibility to beetle attack through reducing basal area or controlling other stand conditions. They are preventive treatments that should be completed prior to stands experiencing beetle outbreaks. Stand hazard rating for *Dendroctonus* bark beetles of ponderosa pine involves measures of tree size, stand or group density (basal area), and the percent of host trees within the stand. No stand hazard rating models have been validated for pine engraver beetles species attacking ponderosa pine in Arizona, primarily because beetle populations are often driven by drought and factors leading to large amounts of slash. Stand hazard rating for *Dendroctonus* bark beetles attacking ponderosa pine typically involves measures of tree size, density (basal area or stand density index), and the percent of host trees within the stand. In general, ponderosa pine stands that have an average DBH greater than 12 inches and a basal greater than 120 ft²/acre are considered at high risk to bark beetle attack, stand basal area of 80 – 120 ft²/acre are moderate risk, and stand basal area less than 80 ft²/acre are considered low risk (Schmid and Mata, 1992; Chojnacky et al., 2000; Negrón et al., 2000).



Figure 3. *Ponderosa pine currently infested with bark beetles within the Whisper Restoration Project area.*

Although no stand hazard rating system has been developed for bark beetles attacking ponderosa pine on the Payson RD specifically, Munson and Anhold (1995) developed the following stand hazard rating system for mountain pine beetle in ponderosa pine (table below modified from Chojnacky et al., 2000). This hazard rating system was validated across several sites including the North Kaibab in Arizona.

<u>% PP</u>		<u>Ave. PP DBH</u>		<u>Basal Area (ft²/ac)</u>		<u>Composite Stand Hazard Values</u>	<u>Hazard Rating</u>
>85	(3)	>12	(3)	>120	(3)	8 – 9	High
50-85	(2)	8-12	(2)	80-120	(2)	5 – 7	Moderate
<50	(1)	<8	(1)	<80	(1)	3 – 4	Low

For prevention of western pine beetle attacks in California, thinning of dense, 70- to 80-year-old sawtimber stands is an effective silvicultural method for managers of both small and large holdings (DeMars and Roettgering, 1982). Demars and Roettgering (1982) state that by reducing stand stocking to 55 to 70 percent of the basal area needed for full site utilization will relieve the competitive stress among the residual trees, improve their vigor, and make them less prone to successful bark beetle attack.

Because of the more xeric conditions in the Arizona compared to other western states that have ponderosa pine, the low risk category may be even less than 80 ft²/acre. Also, because of the large complex of pine engraver beetles that typically cause the majority of ponderosa pine in the Arizona, average stand diameter may not be as important as other areas in the West where *Dendroctonus* beetles cause most of the tree mortality.

Careful management of the thinning slash is recommended while bark beetle populations are high. Thinning will usually be most effective in areas that are not currently experiencing high levels of beetle activity. In general, population increases of pine engraver beetle can be minimized by implementing thinning projects after the onset of the monsoon season through December. Cutting trees during this season will allow the material to partially dry out before beetles fly in the spring. Also standing residual trees may be less susceptible during this time due to increased soil moisture caused by the monsoon rains. Slash generated from January through May typically remains moist and enhances beetle population increases. While this is a good general recommendation when beetle populations are relatively low, we have observed pine engraver beetles to complete at least one generation in slash generated during the fall of 2002 and 2003 on most Forests in Arizona. If this timing approach is being used, and trees are only lopped and left on untreated on the site, there are a couple points to consider. First, slash generated on more exposed areas that have relatively low residual basal area will likely dry out more by the time beetles fly in the spring. Second, on steeper slopes or where the residual basal area is still relatively high, slash may not adequately dry out by the time beetles fly in the spring.

Another general “rule of thumb” approach to preventing pine engraver beetles from impacting areas where thinning projects are being implemented is to separate project areas either in time and/or in space. Beetle populations probably will remain relatively low if thinning projects are conducted every other year. Similarly, a buffer of over two miles between management sites is also thought to prevent mass movement of beetles from one area to another. If thinning treatments are implemented in consecutive years, there likely will be a build up of pine engraver beetles that can move from one thinning project to the next.

The best preventive strategy to minimize pine engraver beetle activity related with thinning projects and associated slash is to utilize the larger diameter slash. Harvesting most ponderosa pine slash larger than 4 inches in diameter will help to prevent beetle populations increases because few beetles are produced in slash less than 4 inches because this material dries out quicker and there can be more competition for less food. The larger diameter slash should be removed from the site or treated within 28 days of being generated if thinning occurs during active beetle flight periods (April through early October). If thinning occurs during November through March, the larger diameter material should be removed or treated before the time beetles complete their first generation in the spring (i.e., by early May). If slash does become infested in April, removing or treating the newly infested material may aid in reducing the local population of pine engraver beetles.

Recommendations

Current stand conditions within the Whisper Restoration Project area are conducive to high fire risk and are susceptible to bark beetle attack. Although the proposed pre-commercial thinning treatments do not include a target basal area, most of the areas treated should have a resulting ponderosa pine basal area below 80 ft.²/ac; this will help to reduce the overall susceptibility of stands to bark beetles in the long term. Thinning from below has been experimentally demonstrated to increase the resistance level of the residual mature pine overstory (Feeney, et al., 1998). If post-thinning evaluations indicate a need to further density reduction, the Payson Ranger District has the option to offer these areas as a commercial timber sale and therefore basal area could be further reduced to minimize future bark beetle susceptibility. The reduction in basal area and understory and mid-canopy vegetation will also decrease fire risk to the surrounding communities.

As mentioned above, thinning slash may pose a short-term risk to residual trees in the thinning units or surrounding areas depending on the timing of thinning, local population of *Ips*, and site and environmental factors such as site quality and precipitation. Our office can provide additional assistance to help minimize bark beetle activity associated with thinning treatments.

Prevention and Suppression funds may be available for FY2005 from Forest Health Protection to implement projects related to bark beetle activity in these forest health project areas. Requests for these funds should be submitted no later than October 15, 2004.

If you have any questions regarding my assessment of current bark beetle activities within the area, its potential effect on residual standing trees, or my recommendations, please let me know.

/s/ Joel D. Mcmillin
JOEL D. McMILLIN
Entomologist, Forest Health, Arizona Zone

cc: James A Mercer, John Anhold, Debra Allen-Reid, Leonard Lucero, Mailroom R3 Tonto

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